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Because of the increasing use of color in instructional materials at the level of the primary grades, the Health Service Department of the Denver Public Schools became interested in investigating the color vision of 5- and 6-year-olds. A project was established to create color-vision testing methods and to use those methods to ascertain incidence and to identify color-deficient pupils. The two basic types of tests used were (1) color matching and (2) recognition of colored symbols differentiated from surroundings of other colors. Some 3,400 children were tested during the 1967-68 school year. It was found that the tests used were practical for their age group. The tests produced high interest and should be used either in the latter part of kindergarten or in the first grade. The incidence of some degree of color deficiency was 0.5 percent for girls and 3.0 to 3.5 percent for boys. The color-symbol tests were significantly more definite than the color-matching test. (WD)

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AN EVALUATIVE STUDY OF COLOR-VISION TESTS FOR KINDERGARTEN AND FIRST GRADE PUPILS

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The part that color-vision plays in the life of every individual has been recognized and studied since John Dalton described his own color deficiency in 1807. In addition to the esthetic aspects involved, there are practical applications in every day living. Color-vision testing has been undertaken by a wide variety of groups for divergent purposes. Implications for industry, the military, commercial transportation (airlines, railroads, and buses), and traffic are obvious and important. Many tests have been developed and are in common usage. Most adults have experienced one or another of the color-vision tests in connection with driver licensing, pre-employment health evaluations, and the like. Schools too have been aware of the significance of this aspect of vision. Testing has been done in the secondary school in connection with vocational counselling. Based upon this rather wide experience, incidence of color deficiency has been reasonably well established (males 3+%, females 0.5%). Understanding of the basic physiology of color-vision has increased since the early work of Young and Helmholtz more than 150 years ago. At the present time then, there is a reasonable body of knowledge concerning color-vision, methods of testing, and theory related to its mechanisim.

The relationship between color-vision and learning has received little attention until the last ten years. Classically, little use of color has been made in instruction. With the advent of increased interest in the learning process, and particularly in dysfunctions of the processes, this situation has undergone considerable change. Today color is being more and more widely used in instruction, especially in the primary grades. A great many examples could be given -

Slides #1 and #2

The Cuisenaire Rods, Words in Color, and The Sullivan Programmed Primer are but a selected few. With this increase in the use of color it is logical to question the characteristics of color perception among the users of these new materials, that is, among the young school-age children. Upon investigation it appears that little has been done with the five and six year old group in regard to color-vision. Many questions remain unanswered. Are ths tests used for older individuals suitable for five year olds? What is the incidence of color deficiency in this age group? Does color-vision make any difference in school? If it does, can the color deficient child be helped?

The Health Service Department of the Denver Public Schools became interested in these questions and has undertaken a study to seek answers. Assistance was sought from the Denver Ophthalmological Society and the Department of Ophthalmology of the University of Colorado School of Medicine. An advisory group of individuals from these agencies met with school personnel to consider details of a study the goals of which would be answers to questions pertaining to color-vision and its' role in learning in the early school years. With this reasoning a study was developed. Essentially it contained two parts. The first part, which is being reported here, consisted of establishing practical testing methods and the use of those methods to ascertain incidence and to identify color deficient pupils. This was done during the 1967-68 school year. The second part consists of correlating known color deficiency with the learning process. Such is still progressing and will not be reported at this time.

Review of the literature, and discussion with the advisory group indicated at least two basic approaches to color-vision testing. One employs color matching in one or another form. The other employs recognition of symbols of the test color differentiated from surroundings of other colors. The familiar yarn test is an example of the first, and the Ishihara Test of the second. Adaptations of both methods that were age suitable were included in this project.

Slide #3

For the color matching part of the testing, a set of test materials was prepared. The set consisted of two muffin tins, the cups of which were painted with test colors, ie, black, white, yellow, blue, red, and green. Identically painted was a set of ping-pong balls. The test was presented to the child being evaluated, with the ping-pong balls in one of the tins with directions to put the balls in the cups of the other tin, matching the color of the ball with the color of the cup. These directions seemed to be readily understood by the five and six year old children who were being tested, and the manipulation necessary also seemed to be within their motoric ability. There was high interest in the test on the part of the children. The test was useful in establishing rapport, and in orienting the subject to the general area of the test.

Slide #4
Slide #5

The symbol recognition part of the evaluation utilized standard Ishihara pseudo-isochromatic color plates, and also the newer American Optical Company's HRR plates. These are illustrated in the accompanying slides. They depend upon the subjects ability to differentiate a symbol in one color from a background of another color.

Because of the ages of the subjects, responses were in terms of finger tracing symbols upon the protected surface of the plate rather than a verbal response as is commonly used with older subjects. Only selected representative plates were used rather than the entire series in both the Ishihara and HRR evaluations. Initially a similar test utilizing a visual testing machine, the Titmus Vision Screener with the color-vision slide was included. Experience with children in the 5 - 6 year age group indicated that this procedure was more time consuming and conceivably introduced other factors (spacial, motoric, and verbal) such that it was empirically discontinued after a trial with several hundred children. An additional dimension was incorporated into the study by questioning the classroom teacher as to her opinion of the adequacy of color-vision of each subject. This was done without knowledge on the part of the teacher as to results of the tests administered.

With the tests described, two individuals (both nurses), tested over 3400 five and six year old children during the second semester of the 1967-68 school year. This experience led to several conclusions:

- tests of this nature are practical for use with kindergarten and first grade children
- the time necessary to administer the tests is approximately two minutes per child once the tests are optimally structured, and the examiners experienced
- optimal timing is in the middle or later part of the kindergarten year, or any time in the first grade year
- teacher-pupil interest is high and could be utilized in correlation with associated learning.

In addition to these conclusions of a general nature, this study was analyzed for conclusions from the raw data. Additional conclusions were as follows:

- the incidence of some degree of color deficiency was in the order of 0.5% for girls and 3.0 to 3.5% for boys
- the color matching test was significantly less definitive than the color symbol tests
- teacher judgment should not be used in lieu of the more sensitive tests.

In general it was the feeling of all those involved in the project that the testing of color-vision can be undertaken with children of initial school entrance age with expectation of valid test results at a reasonable investment of time. Further studies are needed to determine correlations and practical implications in the total learning process of elementary school children.

Appreciation of the varied efforts of the advisory group, the testors, the school administrators, and of the pupils and teachers who took part, is extended.

Details of the initial planning, technical aspects of the tests used, and specifics of the analysis of the study, were not included as being inappropriate to this presentation, but are available to interested parties upon request. We would encourage other school districts to undertake similar studies and would appreciate hearing of their results.

Thank you.

REFERENCES

1. The Physiologic Basis of Medical Practice
Bast and Taylor, 8th Edition 1966
Williams and Wilkins - page 301 and following

2. Color-Vision Anomalies and Elementary School Achievement
John Mardola, Journal of Association for Study of Perception
II: 2521, Fall 1967

3. Color-Vision Defective Eighth Grade Boys
H. J. Ridge, Unpublished Master's Thesis
University of Colorado, 1966

4. The Relationship of Colors to Various Concepts
Harry S. Beck, Journal of Educational Research, LIII
January 1960 - pages 194-196

5. Color: A Guide to Basic Facts and Concepts
Robert Burnham, Randall M. Hanes, and C. James Bartleson
New York: John Wiley and Sons, Inc., 1963 - page 249

6. The Fifth Mental Measurement Yearbook
Oscar K. Buros (ed.), The Gryphon Press, 1959
Highland Park, New Jersey - page 1292

7. Relationships Between Age, Visual Acuity and Color-Vision
Alphonse Chapanis, Human Biology, XXII
February 1950 - pages 1-33

8. Psychology of Exceptional Children and Youth
William M. Cruickshank (ed.), Prentice-Hall, Inc., 1963
Englewood Cliffs, New Jersey - page 623

9. What is Color Blindness
Education LXXXIII, November 1962 - pages 174-178
Israel Dvorine

10. Visual Handicaps to Reading
Thomas H. Eames, Journal of Education CXLI
February 1959 - pages 1-34

11. Color Preference and Employment in Children's Drawings
Arthur O. England, Journal of Child Psychiatry, II
1952 - pages 343-349

12. Color as an Aid in Teaching
Leland H. Erickson, The Arithmetic Teacher V
February 1958 - pages 10-14

13. Dictionary of Education
Carter V. Good (ed.), McGraw-Hill Company, Inc., 1959
New York - page 676

14. Efficient Visual Functioning and the Learning Process
Albert F. Grau, Education LXXXIV
February 1964 - pages 362-367

15. British Teachers' Reactions to the Cuisenaire-Gattegno Materials (The Color-Rod Approach to Arithmetic)
Charles F. Howard, The Arithmetic Teacher IV
November 1957 - pages 191-195

16. Form, Color, and Size in Childrens' Conceptual Behavior
Jerome Kagan and Judith Lemkin, Child Development XXXII
March 1961 - pages 25-28

17. Color
Grace E. Koerner, Grade Teacher LXXVII
April 1960 - pages 20, 30, 132

18. An Essay on Color-Vision and Clinical Color-Vision
Arthur Linkez, Griene and Stratton, 1964
New York - page 254

19. Light, Vision, and Seeing
Matthew Luckiesh, D. Van Nostrand, Inc., 1964
New York - page 323

20. The Science of Seeing
D. Van Nostrand Company, Inc., 1937
New York - page 548

21. Learning from Films
May, Mark Arthur, and Arthur A. Lumsdaine,
Yale University Press, 1958 - New Haven, Connecticut - page 357

22. The Science of Educational Research
George J. Mouly, American Book Company, 1963
New York - page 415

23. Color
John G. Navarra, The Instructor, LXIII
May 1964 - pages 74-75

24. Individual Differences in Color-Vision
Ralph W. Pickford, The Macmillan Company, 1951
New York - page 386

25. Childrens' Preferences for Color Versus Other Qualities in Illustrations
Mabel Rudisell, The Elementary School Journal, LII
April 1958 - pages 444-451

26. Color in Discriminative Learning by Children
J. J. Staley, Willard H. Nelson, and F. J. King
The Journal of Experimental Education, III, March 1963 - pages 325-326

27. Color-Vision
Richard C. Teevan, and Robert C. Birney
D. Van Nostrand Company, Inc., 1961, New Jersey - page 214

28. Color-Vision Defects in American School Children
Horace C. Thuline
Journal of the American Medical Association, CLXXXVIII
May 11, 1964 - pages 514-518

29. Light and Color: Aids to Learning
Harold V. Webb, The American School Board Journal
August 1957 - pages 42-44 and 68